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FLAME-RETARDANT AND ANTICORROSIVE SURFACE COATINGS OF POLYANILINE/MAGNESIUM HYDROXIDE NANOCOMPOSITES PREPARED FROM DOLOMITE

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Polyaniline (PANI) is widely used as an anticorrosive protective coating on various metal surfaces. However, these organic coatings can be damaged or burnt by fires and flames. This problem can be circumvented, to a certain extent, by incorporating a flame retardant to the coating. Magnesium hydroxide [$Mg(OH)_2$] is such a flame retardant, which is commonly used in combination with many polymers. Therefore, in this study, a novel nanocomposite of PANI/$Mg(OH)_2$ is synthesized starting from naturally occurring dolomite. In this method, powdered dolomite was heated, at 900 °C, for 3 h, to produce calcined dolomite (CaO.MgO). The calcined dolomite was added to 1 M sucrose solution, to dissolve its CaO in sucrose forming water-soluble calcium sucrate, leaving MgO as a precipitate. The precipitated MgO product was digested in 1 M HCl solution to produce an $MgCl_2$ solution, at pH 5. The $MgCl_2$ (50.0 mL) was mixed with 2.3 mL of aniline and, into this solution, 1 M sodium hydroxide (100.0 mL) and 1 M potassium persulfate (50.0 mL) solutions were added, simultaneously and drop-wise, while stirring. The resulted precipitated product of PANI/$Mg(OH)_2$ composite is collected, by centrifuging, and was dried well, in a vacuum oven, at 45 °C and 60 mmHg, for 12 h. The composite is mixed with xylene and alkyd resin to produce an anticorrosive coating on mild steel. For comparison, mixtures of alkyd resin and xylene without any PANI or $Mg(OH)_2$, and that with only PANI were also prepared and the corresponding coatings were applied on identical mild steel surfaces. Also, coatings are applied on a standard A4 paper, and then burnt under the flame of Bunsen burner to study flame retardation characteristics of the coatings. X-ray diffraction pattern of the composite revealed the presence of brucite crystalline form of $Mg(OH)_2$ in the composite. By applying the Debye-Scherrer formula to the major peak of XRD of the composite, the crystallite size of brucite is estimated to be 13 nm. Fourier Transform Infrared (FT-IR) spectroscopic studies confirm the presence of PANI and $Mg(OH)_2$ in the composite. According to the Tafel plots obtained for coatings on mild steels, corrosion rate of mild steel has been decreased by 275 times by applying PANI/$Mg(OH)_2$ composite coating. Therefore, the PANI/$Mg(OH)_2$ nanocomposite is useful as a surface coating with properties of flame retardation and anticorrosion.

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